AMENDMENTS TO THE CLAIMS

Claims 1-53 (Canceled)

Claim 54 (New) A carbon nano-fibrous rod comprising:

a hexagonal carbon layer having a central axis extending in one direction.

Claim 55 (New) The carbon nano-fibrous rod according to claim 54, wherein

an axial width (D) of the hexagonal carbon layer is 2.5±0.5 nm, and

a length (L) of the hexagonal carbon layer is 17±15 nm.

Claim 56 (New) The carbon nano-fibrous rod according to claim 54, wherein

2 to 12 of the hexagonal carbon layers are stacked.

Claim 57 (New) Fibrous nanocarbon comprising:

a plurality of the carbon nano-fibrous rods of claim 54 gathered together.

Claim 58 (New) The fibrous nanocarbon according to claim 57, wherein

the carbon nano-fibrous rods are stacked in a three-dimensionally close-packed state.

Claim 59 (New) The fibrous nanocarbon according to claim 57, wherein

the plurality of the carbon nano-fibrous rods are stacked, with central axes thereof being parallel to each other, to constitute a carbon nano-fibrous rod cluster.

Claim 60 (New) The fibrous nanocarbon according to claim 59, wherein

the carbon nano-fibrous rod cluster comprises the carbon nano-fibrous rods three-dimensionally stacked, with nano-gaps being provided between the carbon nano-fibrous rod comprising the 2 to 12 of the hexagonal carbon layers stacked and the carbon nano-fibrous rod comprising the 2 to 12 of the hexagonal carbon layers stacked.

Claim 61 (New) The fibrous nanocarbon according to claim 57, wherein

the carbon nano-fibrous rods are joined in series at axial end portions to constitute a carbon nano-fibrous rod cluster in an axial direction.

Claim 62 (New) The fibrous nanocarbon according to claim 61, wherein the axial end portions of the carbon nano-fibrous rods are joined by heat treatment.

Claim 63 (New) The fibrous nanocarbon according to claim 59, wherein the carbon nano-fibrous rod cluster is arranged at an arrangement angle of larger than 0 degree but smaller than 20 degrees with respect to an axis perpendicular to a fiber axis in a direction of stack of the carbon nano-fibrous rods, thereby forming a columnar shape.

Claim 64 (New) The fibrous nanocarbon according to claim 59, wherein the carbon nano-fibrous rod cluster is arranged at an arrangement angle of larger than 20 degrees but smaller than 80 degrees with respect to an axis perpendicular to a fiber axis in a direction of stack of the carbon nano-fibrous rods, thereby forming a feather shape.

Claim 65 (New) The fibrous nanocarbon according to claim 63, wherein the carbon nano-fibrous rod cluster has a herringbone structure.

Claim 66 (New) The fibrous nanocarbon according to claim 63, wherein an interplanar distance (d_{002}) between the hexagonal carbon layers is less than 0.500 nm under heat treatment conditions at 700°C or lower.

Claim 67 (New) The fibrous nanocarbon according to claim 63, wherein a fiber width of an aggregate of the carbon nano-fibrous rods is 8 to 500 nm, and a fiber aspect ratio (fiber length/fiber width) of the aggregate is 10 or more.

Claim 68 (New) The fibrous nanocarbon according to claim 61, wherein

the carbon nano-fibrous rod cluster is arranged at an arrangement angle of 80 degrees to 88 degrees with respect to an axis perpendicular to a fiber axis in a direction of stack of the carbon nano-fibrous rods, thereby forming a tubular shape.

Claim 69 (New) The fibrous nanocarbon according to claim 68, wherein

a fiber width of an aggregate of the carbon nano-fibrous rods is 8 to 80 nm, and a fiber aspect ratio (fiber length/fiber width) of the aggregate is 30 or more.

Claim 70 (New) The fibrous nanocarbon according to claim 63, wherein

a cross sectional structure in a direction perpendicular to the fiber axis is polygonal.

Claim 71 (New) The fibrous nanocarbon according to claim 63,

which is heat-treated at a high temperature of 1,600°C or higher, and

wherein ends of the carbon nano-fibrous rods on a surface of the fibrous nanocarbon are two-dimensionally loop-shaped and three-dimensionally dome-shaped.

Claim 72 (New) A method for producing fibrous nanocarbon comprising an aggregate of carbon nano-fibrous rods by reacting a carbon material in a high temperature fluidized bed with use of a catalyst,

comprising using, as a fluid material, a dual-purpose catalyst/fluid material comprising a metal catalyst-supporting carrier bound via a binder, and

comprising performing

a first gas supply step of supplying a reducing gas,

a carbon material supply step of supplying the carbon material in a gaseous state to produce a carbon nano-fibrous rod in a presence of the metal catalyst of the dual-purpose catalyst/fluid material, and

a second gas supply step of supplying a carbon-free gas to eliminate a fluidizing function of the dual-purpose catalyst/fluid material.

Claim 73 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

an average particle diameter of the dual-purpose catalyst/fluid material is 0.2 to 20 mm.

Claim 74 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

the dual-purpose catalyst/fluid material comprises a product formed by supporting the catalyst on a surface of the carrier, or an agglomerate of the products.

Claim 75 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

the carrier of the dual-purpose catalyst/fluid material is any one of carbon black, alumina, silica, silica sand, and aluminosilicate.

Claim 76 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

the metal catalyst of the dual-purpose catalyst/fluid material is any one of Fe, Ni, Co, Cu and Mo, or is a mixture of at least two of these metals.

Claim 77 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

a flow velocity in the fluidized bed is 0.02 to 2 m/s.

Claim 78 (New) The method for producing fibrous nanocarbon according to claim 72, further comprising

controlling conditions for each of the first gas supply step, the carbon material supply step, and the second gas supply step independently of one another.

Claim 79 (New) The method for producing fibrous nanocarbon according to claim 78, wherein

the conditions are a temperature, a pressure, a time, and a gas atmosphere.

Claim 80 (New) The method for producing fibrous nanocarbon according to claim 72, further comprising

bringing the catalyst of the dual-purpose catalyst/fluid material and the carbon material into contact with each other at a temperature of 300 to 1,300°C in a gas mixture of hydrogen and an inert gas (hydrogen partial pressure 0 to 90%) at a pressure of 0.1 to 25 atmospheres, thereby producing the fibrous nanocarbon.

Claim 81 (New) The method for producing fibrous nanocarbon according to claim 72, further comprising

metallizing and finely dividing the catalytic component of the dual-purpose catalyst/fluid material by a reducing action of the reducing gas in at least one of the first gas supply step and the carbon material supply step.

Claim 82 (New) The method for producing fibrous nanocarbon according to claim 81, further comprising

controlling a particle diameter of the metal catalyst of the dual-purpose catalyst/fluid material in finely dividing the metal catalyst, thereby controlling a diameter of the fibrous nanocarbon obtained.

Claim 83 (New) The method for producing fibrous nanocarbon according to claim 72, wherein

the second gas supply step forms a zone at a high flow velocity locally in the fluidized bed to promote fine division and wear of the dual-purpose catalyst/fluid material by a collision between particles of the dual-purpose catalyst/fluid material, or a collision between the particles and a wall surface.

Claim 84 (New) The method for producing fibrous nanocarbon according to claim 83, wherein

the zone at a high flow velocity in the fluidized bed is formed in a lower portion of the fluidized bed.

Claim 85 (New) The method for producing fibrous nanocarbon according to claim 83, wherein

the zone at a high flow velocity is formed by flowing a high velocity gas into the fluidized bed.

Claim 86 (New) The method for producing fibrous nanocarbon according to claim 85, further comprising

supplying particles, which have scattered from the fluidized bed, again into the fluidized bed while entraining the particles in the high velocity gas.

Claim 87 (New) The method for producing fibrous nanocarbon according to claim 72, further comprising

separating the produced fibrous nanocarbon from the carrier or the catalyst.

Claim 88 (New) An apparatus for producing fibrous nanocarbon, which is used in performing the method for producing fibrous nanocarbon according to claim 72, and comprising:

a fluidized bed reactor charged with the dual-purpose catalyst/fluid material and provided with heating means for heating an interior of the fluidized bed reactor;

first gas supply means for supplying the reducing gas into the fluidized bed reactor;

carbon material supply means for supplying the carbon material in a gaseous state into the fluidized bed reactor;

second gas supply means for supplying the gas free from carbon into the fluidized bed reactor; and

a discharge line for discharging a gas and scattered particles from the fluidized bed reactor.

Claim 89 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

recovery means for recovering the scattered particles is provided in the discharge line.

Claim 90 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

a fluidized bed portion of the fluidized bed reactor has a high velocity flow portion and a low velocity flow portion.

Claim 91 (New) The apparatus for producing fibrous nanocarbon according to claim 90, wherein

a collision portion is present in the high velocity flow portion.

Claim 92 (New) The apparatus for producing fibrous nanocarbon according to claim 88, further comprising

high velocity gas blowing means for blowing a gas at a high velocity into the fluidized bed reactor.

Claim 93 (New) The apparatus for producing fibrous nanocarbon according to claim 92, wherein

when the gas is blown at a high velocity, recovered particles are entrained in the gas.

Claim 94 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

a first flow chamber, a second flow chamber, and a third flow chamber, where the fluid material is flowingly movable, are formed within the fluidized bed reactor,

the first gas supply means is connected to the first flow chamber,

the carbon material supply means is connected to the second flow chamber, and

the second gas supply means is connected to the third flow chamber.

Claim 95 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

a first flow chamber and a second flow chamber, where the fluid material is flowingly movable, are formed within the fluidized bed reactor,

another fluidized bed reactor different from the fluidized bed reactor is provided as a third flow chamber,

transport means for transporting the fluid material from the second flow chamber to the third flow chamber is provided,

the first gas supply means is connected to the first flow chamber,

the carbon material supply means is connected to the second flow chamber, and

the second gas supply means is connected to the third flow chamber.

Claim 96 (New) An apparatus for producing fibrous nanocarbon, which is used in performing the method for producing fibrous nanocarbon according to claim 72, and comprising:

a first fluidized bed reactor charged interiorly with the dual-purpose catalyst/fluid material, having heating means for heating an interior of the first fluidized bed reactor, and having first gas supply means for supplying the reducing gas into the first fluidized bed reactor;

a second fluidized bed reactor having transport means for transporting the fluid material from the first fluidized bed reactor, and having carbon material supply means for supplying the carbon material in a gaseous state into the second fluidized bed reactor;

a third fluidized bed reactor having transport means for transporting the fluid material and a reaction product from the second fluidized bed reactor, and having second gas supply means for supplying the gas free from carbon into the third fluidized bed reactor; and

a discharge line for discharging a gas and scattered particles from the third fluidized bed reactor.

Claim 97 (New) The apparatus for producing fibrous nanocarbon according to claim 96,

including a plurality of the first fluidized bed reactors.

Claim 98 (New) The apparatus for producing fibrous nanocarbon according to claim 96,

including a plurality of the second fluidized bed reactors.

Claim 99 (New) The apparatus for producing fibrous nanocarbon according to claim 96,

including a plurality of the third fluidized bed reactors.

Claim 100 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

an average particle diameter of the dual-purpose catalyst/fluid material is 0.2 to 20 mm.

Claim 101 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

the dual-purpose catalyst/fluid material comprises a product formed by supporting the catalyst on a surface of the carrier, or an agglomerate of the products.

Claim 102 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

the carrier of the dual-purpose catalyst/fluid material is any one of carbon black, alumina, silica, silica sand, and aluminosilicate.

Claim 103 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

the metal catalyst of the dual-purpose catalyst/fluid material is any one of Fe, Ni, Co, Cu and Mo, or is a mixture of at least two of these metals.

Claim 104 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

a flow velocity in the fluidized bed is 0.02 to 2 m/s.

Claim 105 (New) The apparatus for producing fibrous nanocarbon according to claim 88, wherein

the catalyst of the dual-purpose catalyst/fluid material and the carbon material are brought into contact with each other for a certain period of time at a temperature of 300 to 1,300°C in a gas mixture of hydrogen and an inert gas (hydrogen partial pressure 0 to 90%) at a pressure of 0.1 to 25 atmospheres, whereby the fibrous nanocarbon is produced.

Claim 106 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

an average particle diameter of the dual-purpose catalyst/fluid material is 0.2 to 20 mm.

Claim 107 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

the dual-purpose catalyst/fluid material comprises a product formed by supporting the catalyst on a surface of the carrier, or an agglomerate of the products.

Claim 108 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

the carrier of the dual-purpose catalyst/fluid material is any one of carbon black, alumina, silica, silica sand, and aluminosilicate.

Claim 109 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

the metal catalyst of the dual-purpose catalyst/fluid material is any one of Fe, Ni, Co, Cu and Mo, or is a mixture of at least two of these metals.

Claim 110 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

a flow velocity in the fluidized bed is 0.02 to 2 m/s.

Claim 111 (New) The apparatus for producing fibrous nanocarbon according to claim 96, wherein

the catalyst of the dual-purpose catalyst/fluid material and the carbon material are brought into contact with each other for a certain period of time at a temperature of 300 to 1,300°C in a gas mixture of hydrogen and an inert gas (hydrogen partial pressure 0 to 90%) at a pressure of 0.1 to 25 atmospheres, whereby the fibrous nanocarbon is produced.